3GPP TSG-RAN WG3 #114e R3-215903

Online, 1 – 11 November 2021

Agenda Item: 13.3.1

Source: Lenovo, Motorola Mobility (moderator)

Title: Summary of Offline Discussion on IAB congestion mitigation

Document for: Approval

# Introduction

This paper provides the summary for following offline discussion:

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| **CB: # 1305\_IAB\_Con\_Mit**  **- It is suggested to work on top of the Was captured at RAN3-113e and to finalise the topics for this AI**  **- Can the following WA be turned into an agreement?**  **- WA: the presence of Child Node Identifier IE is Mandatory, the value of the maxnoofIABCongInd is 1024**  **- Can TPs be agreed as pr agreements?**  **- Can this AI be closed?**  (Lenovo - moderator)  Summary of offline disc [R3-215903](file:///D:/Standards/IAB/Meeting%20List/RAN3/RAN3%20114-e/Inbox/Drafts/Chairs_Notes/Inbox/R3-215903.zip) |

Phase I：Please give your feedback before Thursday, 4th November 2021, 23:59 UTC. This allows us to give some input for Monday’s online session (8th November 2021).

Phase II：TBD.

# For the Chairman’s Notes

The proposals can be agreed:

P1: the value of the maxnoofIABCongInd is set to 1024

P2: Not to specify the MPS exemption for IAB congestion indication.

P3: Agree the TP R3-215609 rev in R3-216041.

With the proposals, the WAs made by last meeting are still valid:

WA: per-BAP routing ID congestion indication will not be pursued in this release.

WA: the presence of Child Node Identifier IE is Mandatory.

# Discussion – 1st Round

## Issue 1: Whether to support per BAP routing ID congestion indication

In the last RAN3 113 e-meeting, following working assumption was achieved for IAB congestion mitigation.

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| --- |
| WA: per-BAP routing ID congestion indication will not be pursued in this release. |

Based on the contribution [2], it is proposed to support the per BAP routing ID level congestion indication. And the proponent thinks that reporting per BAP routing ID can directly indicate the routes which need to be adjusted and per BAP routing ID level congestion indication has been allowed for HbH flow control.

While based on the contributions [4] and [5], it is proposed to not pursue per-BAP routing ID congestion indication in this release. The companies think it will cost too much overhead for per-BAP routing ID congestion indication. In addition, it is sufficient for CU-CP to determine the location of congestion based on the agreed per child link and per BH RLC CH congestion feedback, and CU-CP can infer the congestion status of each routing path from the per child link congestion feedback.

Companies are invited to provide their views on the above options.

***Q1: Please share your view and preference on the following 2 options for whether to support per BAP routing ID congestion indication.***

***Option 1: Support per BAP routing ID congestion indication***

***Option 2: Not to pursue per BAP routing ID congestion indication in this release and change the WA into agreement***

|  |  |  |
| --- | --- | --- |
| Company | Option 1 or 2 | Comment |
| Nokia | Option 2 | We do not see a reason for Option 1. This F1AP message is sent to CU, so CU can know the affected Routing IDs. There is no need to send each Routing ID. There is no scenario that one Routing ID is congested but other Routing ID sharing the same BH RLC CH is not congested. |
| **Ericsson** | Option 2 | Same view as Nokia |
| Samsung | Option 1 | It is hard to say option 1 can cost too much overhead. In some cases, the congested BH RLC CHs may share the same BAP routing ID, which can use BAP routing ID reporting. In some cases, the congested routing paths corresponding to different BAP routing IDs may share the same BH RLC CH, which can use BH RLC CH reporting. Thus, allowing both per BAP routing ID and per BH RLC CH is the best way to save the signaling overhead, and we cannot say per BAP routing ID reporting causes more overhead.  In HbH flow control, both per BH RLC CH and per BAP routing ID reporting are defined. There is no reason to not support this over F1-C. From the viewpoint of congestion indication, HbH flow control and E2E flow control have no difference. |
| Lenovo | Option 2 | Data congestion is expected to occur at a BH link or BH RLC CH granularity, it is sufficient for CU-CP to determine the location of congestion based on the agreed per child link and per BH RLC CH congestion feedback. For the case “different BAP routing IDs may share the same BH RLC CH” proposed by Samsung, since CU-CP has all the information about routing and bearer mapping, CU-CP can infer the congestion status of each routing path based on the per child link and per BH RLC CH congestion feedback.  For HbH flow control, since parent IAB node cannot be aware of the DL egress BH RLC CH of the child IAB node, then the HbH flow control is reported via per ingress BH RLC CH, or the per BAP routing ID level flow control feedback is introduced to distinguish different child IAB nodes which cannot be aware by the parent node. However, E2E flow control doesn’t have this issue. |
| ZTE | Option 1 | Reporting per BAP routing ID congestion indication is beneficial, because it can directly indicate the routes which need to be adjusted. Besides, packets configured with the same routing ID may be mapped to different BH RLC channels. In this case, reporting per routing ID congestion indication requires less overhead than reporting per BH RLC channel congestion indication. |
| QCOM | Option 2 | We already agreed on the WA that per-BAP routing ID congestion indication will not be pursued.  The WA can be revoked if there is new ground-breaking evidence against it. The above contributions do not indicate such evidence. |
| CATT | Option 1 | CU-CP congestion mitigation is the “finial” method. When the CP-based congestion mitigation is triggered, it usually means that the congestion is serious, possibly not just one node (link) congestion but multiple nodes (links). It can reduce the signaling consumption for per child link |
| Fujitsu | Option 1 | It aligns with HbH flow control granularity and the trigger may be related to HbH flow control.  For the concern about the overhead per BAP routing ID, the IAB-node can choose from per BAP routing ID or per BH RLC CH + child node identifier. The report per BAP routing ID may have less overhead in some cases. |
| Huawei | Option 2 | Normally, if some BH link is congested, all the routing path includes such BH link will be impacted, if the BAP routing ID level indication is reported, the overhead will be rather high. Besides, the per BH link level congestion indication has been introduced, and the CU-CP is aware of that the routing path indicated by a BAP routing ID consists of which links, so it can deduce the congestion status of each routing path based on the per child link congestion feedback.  Based on the above concerns, we see no additional benefits offered by per BAP routing ID level congestion indication. |
| AT&T | Option 2 |  |

Summary:

Based on the comments above. 6/10 companies propose to confirm the WA last meeting. And 4/10 companies prefer to support per BAP routing ID congestion indication. Because we already have agreed the WA that per-BAP routing ID congestion indication will not be pursued in last meeting, and we don’t find additional strong evident than last meeting to support per-BAP routing ID congestion indication. Moderator believes we can have the following proposal.

**Proposal 1-1: Turn the following WA into agreement.**

* **WA: per-BAP routing ID congestion indication will not be pursued in this release.**

## Issue 2: Presence of *Child Node Identifier* IE and Value of *maxnoofIABCongInd*

In the last RAN3 113 e-meeting, following working assumption was achieved for IAB congestion mitigation.

|  |
| --- |
| WA: the presence of Child Node Identifier IE is Mandatory, the value of the maxnoofIABCongInd is 1024 |

For the presence of *Child Node Identifier* IE, contributions [1] [4] and [5] propose that the presence of *Child Node Identifier* IE should be Mandatory since the *Child Node Identifier* IE must be included for both per child link and per BH RLC CH congestion feedback. For per BH link level feedback, *Child Node Identifier* is needed to identify the corresponding BH link between reporting IAB node and its child IAB node. And for per BH RLC CH level feedback, *Child Node Identifier* is also needed to identify the BH link which the reported BH RLC CH(s) locates.

While contribution [2] support proposes that the presence of *Child Node Identifier* IE should be Optional for per BAP routing ID congestion indication.

***Q2: Please share your view and preference on the following 2 options for presence of Child Node Identifier IE.***

***Option 1: Mandatory***

***Option 2: Optional***

|  |  |  |
| --- | --- | --- |
| Company | Option 1 or 2 | Comment |
| Nokia | Option 1 |  |
| **Ericsson** | Option 1 | Without *Child Node Identifier* IE, the indication is useless. |
| Samsung | Option 2 | If per BAP routing ID reporting is supported, this IE should be optional |
| Lenovo | Option 1 | As answered in Q1. If per BAP routing ID congestion indication is not supported in this release. *Child Node Identifier* IE must be included for both per child link and per BH RLC CH congestion feedback. |
| ZTE |  | This depends on Q1 |
| QCOM | Option 1 | The sending of the congestion indication is already optional. In case the IAB-node decides to send this indication, we don’t see what it would gain by NOT including the child node ID. |
| CATT |  | Depends on Q1 |
| Fujitsu | Option 2 | If we support per BAP routing ID congestion indication (depending on result of Q1). |
| Huawei | Option 1 | **Presence of *Child Node Identifier* IE: Mandatory**. If the congestion indication is per BH RLC CH, the child node ID is needed to indicate the specific BH RLC CH since the BH RLC CH is identified by the BH link ID+ BH RLC CH ID. If the congestion indicator is per BH link, the child node ID is used to indicate the BH link which is congested. |
| AT&T | Option 1 |  |

For the value of *maxnoofIABCongInd*, as specified in TS 38.473, the maximum number of *maxnoofChildIABNodes* which indicates the child nodes served by an IAB-DU or IAB-donor-DU is set to 1024 for *Child-Nodes List Item* IE. Therefore, contributions [1] [2] [4] and [5] propose that the value of *maxnoofIABCongInd* is also set to 1024.

***Q3: Do you agree that the value of maxnoofIABCongInd is set to 1024?***

|  |  |  |
| --- | --- | --- |
| Company | Yes/No | Comment |
| Nokia | Yes |  |
| **Ericsson** | Yes |  |
| Samsung | Yes |  |
| Lenovo | Yes |  |
| ZTE | Yes |  |
| QCOM | Yes |  |
| CATT | YES |  |
| Fujitsu | Yes |  |
| Huawei | Yes | **Value of the *maxnoofIABCongInd*: 1024**. This value align with the maximum child nodes served by an IAB-DU or IAB-donor DU, as defined in Rel-16. |
| AT&T | Yes |  |

Summary:

For the presence of Child Node Identifier IE, 6/10 for Mandatory, 2/10 for Optional, and 2/10 pending on the result of Q1.

As the summary in Q1, the moderate suggests the presence of Child Node Identifier IE is Mandatory.

And all companies agree that the value of maxnoofIABCongInd is set to 1024.

Then we can have the following proposal.

**Proposal 1-2: Turn the following WA into agreement.**

* **WA: the presence of Child Node Identifier IE is Mandatory, the value of the maxnoofIABCongInd is 1024**

## Issue 3: IAB Congestion Mitigation MPS exemption

Based on the following specification on Section 12.3.9.3.1 of TS 29.274.

* *GTP requests related to priority traffic (i.e. eMPS as described in 3GPP TS 22.153 [62]) and emergency have the highest priority.  Depending on regional/national requirements and network operator policy, these GTP requests shall be the last to be throttled, when applying traffic reduction, and the priority traffic shall be exempted from throttling due to GTP overload control up to the point where the requested traffic reduction cannot be achieved without throttling the priority traffic.*

Contribution [3] proposes a new issue for IAB congestion mitigation. They think that Multimedia Priority Service (MPS) provides priority treatment to increase the probability of an authorized Service User’s Voice, Video, and Data communication. And then priority traffic (e.g. MPS) at the IAB-DU and at intermediate IAB-nodes shall be exempted from overload reduction policy throttling/re-routing at the gNB-CU up to the point where the backhaul congestion mitigation cannot be achieved without throttling/re-routing the priority traffic.

***Q3: Do you agree to introduce MPS exemption for IAB congestion mitigation as proposed in [3]?***

|  |  |  |
| --- | --- | --- |
| Company | Yes/No | Comment |
| Nokia | Yes with comments | Agree the MPS traffic shall be exempted. Suggest small re-wording, e.g. to align with other spec on the MPS traffic.  If required by the regional/national requirements and network operator policy, priority traffic (e.g. MPS) transferred via the congested child node or the congested BH RLC CH shall be exempted… |
| **Ericsson** | See comment | As much as we understand the motivation, we need to point out that RAN3 will not specify actions or policies for mitigating the backhaul congestion. The configuration of the network can enforce the policy and the operator must anyway obey the national/regional guidelines. |
| Samsung | No | Is this issue dedicated for IAB? We understand that in the legacy CU-DU split case, MPS is also allowed. However, we didn’t have any specific operation for MPS in the specification. |
| Lenovo | No | Agree with Samsung that MPS is not a IAB specific issue. |
| ZTE | No | The MPS traffic handling in case of congestion mitigation is not IAB specific and could be up to implementation. |
| QCOM | No | Agree with Ericsson, Samsung and ZTE. |
| CATT |  | It is up to implementation |
| Fujitsu | Maybe no | It should be CU’s decision on how to mitigate congestion hence should not be specified. |
| Huawei | No |  |
| Peraton Labs | Yes | We agree that the legacy CU-DU split should also be subject to the same MPS exemption; it was not introduced in this CR since the WID is IAB specific, and the CR scope stays within the WID; legacy case will be addressed in a separate CR.  There are other cases in RAN3 specifications where provisions for priority treatment have previously been specified such as in cases of overload (TS 38.413 Section 8.7.7.2). |
| AT&T | Yes | OK with Nokia’s rewording |

Summary:

8/11 companies prefer not to specify the MPS exemption, and 3//11 companies support it.

Given that majority companies think it can be left to implementation and doesn’t need to be specified. Moderator suggests having following proposal:

**Proposal 2: Not to specify the MPS exemption for IAB congestion indication.**

## Issue 4: Other updates for BL CR TS 38.473

In contribution [5], following wording improvements are made in section 8.2.7.2 for IAB congestion mitigation.

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| --- |
| 8.2.7.2 Successful Operation   Figure 8.2.7.2-1: gNB-DU Status Indication procedure  If the *gNB-DU* *Overload Information* IE in the GNB-DU STATUS INDICATION message indicates that the gNB-DU is overloaded, the gNB-CU shall apply overload reduction actions until informed, with a new GNB-DU STATUS INDICATION message, that the overload situation has ceased.  The detailed overload reduction policy is up to gNB-CU implementation.  If the *IAB Congestion Indication* IE is present in the GNB-DU STATUS INDICATION message and only includes the *Child Node Identifier* IE, the gNB-CU shall, if supported, consider that the backhaul link to the child node is congested. If the *IAB Congestion Indication* IE is present in the GNB-DU STATUS INDICATION message and includes both the *Child Node Identifier* IE and the *BH RLC CH ID* IE, the gNB-CU shall, if supported, consider that congestion occurs to the corresponding BH RLC channel(s) over the link towards the node identified by the *Child Node Identifier* IE. |

***Q4: Do you think the above wording improvements are agreeable?***

|  |  |  |
| --- | --- | --- |
| Company | Yes/No | Comment |
| Nokia | Yes |  |
| **Ericsson** | Yes, and | Perhaps “occurs to” should be changed to “occurs on”. |
| Samsung | Yes |  |
| Lenovo | Yes |  |
| ZTE | Yes |  |
| QCOM | Yes |  |
| CATT | Yes |  |
| Fujitsu |  | It is better to keep the NOTE for clarification. OK with other changes. |
| Huawei | Yes | As proponent, we think the updates make thing clearer. |
| AT&T | Yes |  |

Summary:

All 10 companies agree the wording improvements.

**Proposal 3: Agree the wording improvements of section 8.2.7 in R3-215609.**

## Issue 5: Others

***Q5: Please provide view if any issue is missing in above discussion or can this AI be closed after resolving the above issues.***

|  |  |
| --- | --- |
| Company | Comment |
| **Ericsson** | The AI can be closed. |
| Lenovo | This AI can be closed after resolving the above issues. |
| QCOM | Agree, the AI can be closed. |
| CATT | Update the TP accordingly, if needed, and this AI can be closed |
| Huawei | Agree with Lenovo |
|  |  |
|  |  |
|  |  |

Summary:

All 5 companies agree to close this AI.

# Discussion – 2nd Round

[TBD]

# References

1. R3-214825 (TP for IAB BL CR for TS 38.473) Congestion Mitigation in IAB Networks Ericsson
2. R3-214929 (TP for NR\_IAB\_enh BL CR for TS 38.473): Congestion indication in CP-based congestion mitigation ZTE
3. R3-215008 (TP for IAB BLCR 38.473) IAB Congestion Mitigation MPS exemption Peraton Labs, CISA ECD, AT&T, Verizon
4. R3-215305 (TP for IAB BL CR for TS 38.473) Remaining issues on congestion mitigation for IAB Lenovo, Motorola Mobility
5. R3-215609 Discussion on IAB congestion mitigation Huawei